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Development of a collision avoidance system at infrared wavelength

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Abstract To avoid collision of two moving systems, a collision avoidance system was developed using Infrared digital coded communication system. The Transmitter power of the Infrared source is adjusted so that the communication will be possible at a distance between the moving systems at which collision avoidance is required

Keywords Collision Avoidance system, digital code generator (ROM), infrared LED driver

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1. Introduction

Two objects approaching towards each other often encounter mutual head-on collision creating disaster. To avoid such collisions an infra red (IR) automatic collision avoidance system has been developed by the millimetre wave group at the Institute of Radio Physics and Electronics, C. U. [1]. Actually, this is a remote controlled transceiver system which stops the object before accident after giving an alarm.

The transmitter sends a signal and the transmitted power is adjusted so that after a certain distance the detector cannot detect the signal level. This distance is adjusted up to the safety region. So initially when the objects are at safe distances, there is no communication. Now if the two objects enter into the danger zone, the receiver detects the signal, there is communication and immediately the power is cut off.

2. Experimental setup

The main components of the transmitter are a digital code generator (ROM) and an IR LED driver (Figure 1). A ROM chip is the fundamental block of the transmitter. Different digital codes are stored at different address location of this ROM. The ROM is triggered by a crystal oscillator at 455 kHz. By proper hardware connection, a particular address location of the ROM is chosen.

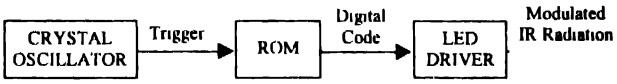

Figure 1. Block diagram of the transmitter

So when the crystal oscillator triggers the ROM, required twelve bit digital code will be obtained at the output of ROM. This digital code is then fed to a current driver. This twelve bit digital coded electrical signal is converted to digital code modulated Infra red radiation by using an LED at the output. Finally, this amplitude modulated IR radiation is transmitted.

The fundamental block of the receiver is a microprocessor-based decoder (Figure 2). The receiver mainly consists of an IR sensor; a microprocessor based decoder chip, an EEPROM chip, control circuits and a relay driver circuit. When two objects enter within the danger zone initiating the probability of collision, the modulated IR radiation from the transmitter is received by the receiver.

At first, the IR sensor detects the signal. The signal is then amplified and processed by the pulse processor to get the

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TTL level. This signal is then fed to the microprocessor based intelligent decoder. When the desired code is received, the output of the intelligent receiver is then used to drive a replay, which finally stops the moving object by disconnecting their power supply. For initial data loading from the EEPROM, a logic module for initialisation is added to the main circuit. Also to avoid the latching of the decoder, another logic module is attached.

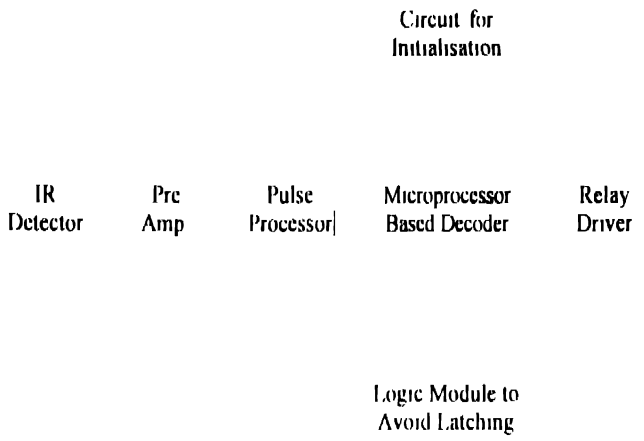

Figure 2. Block diagram of the Receiver

To avoid the congested low frequency part, IR frequency is used in the system, which also provides large bandwidth and narrow beam-width. The coded communication system provides a complete secured communication as the intelligent receiver responds to a particular code only and will not be affected by any other stray signal. Other beneficial features of the system are smaller size, portability and lower cost [2].

References

[1] Technical know-how document on *"Collision avoidance system at infrared wavelength"* (project sponsored by TISCO) (1996)

[2] *An Infrared Digital Communication Link with Transmitter Beam Expander and Receiving Telescope for Computer Communication* S Bhattacharyya, M Dan, R Bera, A Maitra, A K Sen CODEC-98 (Science city, Calcutta, January) (1998)